

ETHEOSTOMA RUBRUM, A NEW PERCID FISH OF THE SUBGENUS
NOTHONOTUS FROM BAYOU PIERRE, MISSISSIPPI

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ABSTRACT

Etheostoma (*Nothonotus*) **rubrum** is described from 209 specimens taken from Bayou Pierre or its tributary, White Oak Creek, Mississippi River System, Copiah County, in southwestern Mississippi. *Etheostoma rubrum* is a diminutive species. It is the smallest, except for *tippecanoc*, in the subgenus *Nothonotus*. The closest relative of *rubrum* is *moorei*. *E. rubrum*, *E. moorei*, and an undescribed species from the Cumberland and Tennessee Rivers form a species group in the subgenus *Nothonotus*. A comparison of *rubrum* and *moorei* shows that the differentiation in most meristic characters is at a relatively low level, but is sharpest in number of lateral line scales. Like other species in the subgenus *Nothonotus*, color pattern is an important species character. The major pattern differences are described. *E. rubrum* is known only from the type-locality. The preferred riffle habitat is probably limited thus yielding a restricted range.

Shortly after our description of *Etheostoma moorei* (1964:131), a related species was found more than two hundred miles distant from any other species of the subgenus *Nothonotus*. *E. rubrum* was noted by Raney and Timothy Zorach during a study of *Etheostoma camurum* (Cope) when a single specimen which had been collected by Ralph W. Yerger and students, Florida State University, was examined. At our request John S. Ramsey and Michael D. Dahlberg, Tulane University, visited the type-

locality of *rubrum* and collected 107 specimens. Later five additional series were collected. We are especially indebted to Dr. Ramsey who made careful color descriptions, habitat notes, and vertebral counts, and to Timothy Zorach, who made most of the counts given in Tables 1 and 2. Measurements (by Raney) and most counts were made in the manner following Hubbs and Lagler (1958:8-15). Scale rows "Anal to first dorsal fin" were counted from a point just laterad of the origin of the anal fin forward and upward to the first dorsal fin base. Scale rows from the "second dorsal to anal fin" were counted from a point just laterad of the origin of the second dorsal fin downward and backward to the anal fin base or to, but not including, the midventral scale. In the text, the genus *Etheostoma* is understood when the generic name has been omitted.

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Etheostoma (*Nothonotus*) **rubrum**,
new species
Bayou Darter
(Fig. 1)

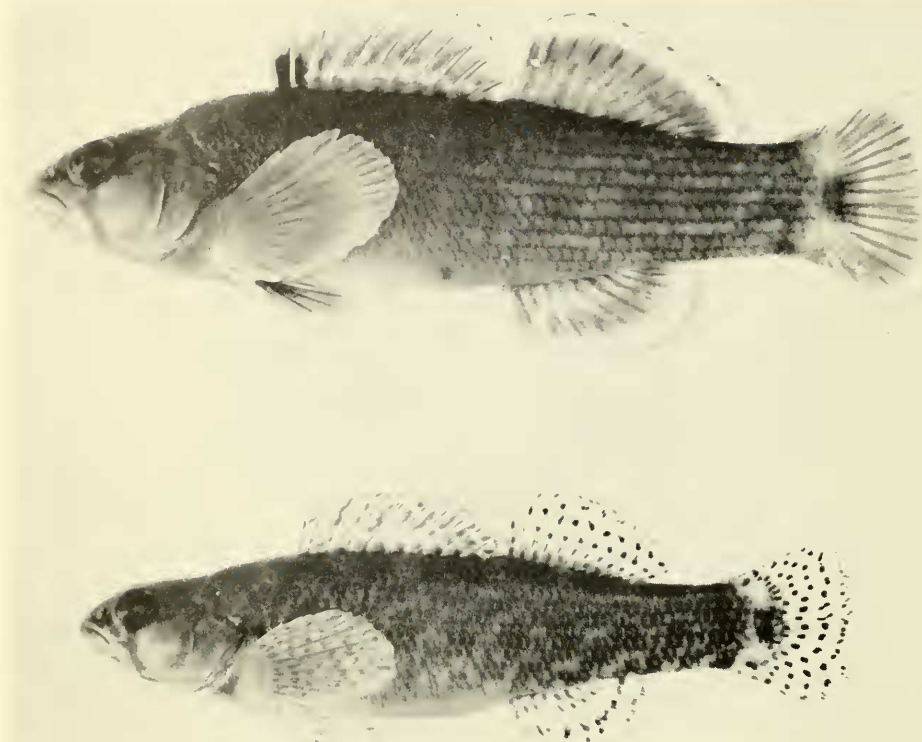
Material: The type-material consists of seven series totaling 209 specimens. All are from Bayou Pierre or its tributary, White

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Photographs by Clyde D. Barbour

Fig. 1. Top. *Etheostoma rubrum*, new species. Paratype adult male, 42.9 mm in standard length, from Bayou Pierre, 8.6 mi SW Utica, Copiah Co., Mississippi, 2 April 1966, TU 40368. Bottom. *Etheostoma rubrum*, new species. Paratype, adult female, 35.9 mm in standard length from the same locality. TU 40368.

Oak Creek, the Mississippi River System, Copiah Co., in southwestern Mississippi. The holotype, Cornell University no. 48232, an adult male 34.9 mm standard length (S.L.), was collected with 106 paratopotypes, 26-40 mm S.L., CU 48233 (53 spec.), and Tulane University 30171 (47 spec.), U. S. National Museum 188899 (6 spec.), on 7 December 1963 by Ramsey and Dahlberg, at Highway 18 crossing, 8.6 mi SW of Utica (junction of Highways 18 and 27). One paratopotype, Florida State University 9275, 35.5 mm S.L., was collected at the same locality on 4 July 1963 by Yerger, R. Birdsong, and T. Fraser. The above specimens were used in the counts which appear in the tables.

Other specimens taken at the type-locality include: CU 46665, 21 paratopotypes, 28-41 mm, 1 February 1964 by Raney and Suttkus; TU 32264, 11 paratopotypes, 28-35 mm, 17 May 1964 by Suttkus and Ram-

sey; TU 37305, 4 paratopotypes, 30-36 mm, 19 March 1965 by Suttkus and Larry Ogren; TU 37451, 53 paratopotypes, 21-39 mm, 28 April 1965 by Suttkus and Francis Rose; TU 40368, 10 paratopotypes, 32-46 mm, 2 April 1966 by Suttkus and G. H. Clemmer.

Two additional paratypes, TU 31341, 32-36 mm, were collected 1 February 1964 in White Oak Creek, a tributary to Bayou Pierre, 2.7 mi S of Utica at Hwy. 18 crossing, Hinds Co., Mississippi by Raney and Suttkus. The data for the comparative materials of *moorei* and *camurum* used in Tables 1 and 2 are given in Raney and Suttkus (1964:132-133).

Diagnosis: A diminutive species. Smallest, except for *tippecanoe*, in subgenus *Nothonotus*. Closest relative is *moorei*. Snout moderately sharp; branchiostegal membranes moderately conjoined; frenum broad; lower jaw included. Body moderately streamlined, anterior two-thirds with

TABLE 1.
Scale counts in *Etheostoma rubrum* (Bayou Pierre, Miss.), *E. moorei*
White River Dr., Ark.) and *E. camurum* (Ohio River Dr.)

Species	Lateral Line Scales															
	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
<i>rubrum</i>	1	2	—	4	7	13	19	27	23	6	6	—	—	—	—	—
<i>moorei</i>	—	—	—	—	—	—	1	2	9	7	14	13	9	3	3	1
<i>camurum</i>	—	—	—	—	—	1	1	3	7	6	4	2	4	2	—	2
	Caudal Peduncle Scales															
	Above Lateral Line				Below Lateral Line								Total			
	7	8	9	10	8	9	10	11	12				18	19	20	21
<i>rubrum</i>	1	65	41	1	—	39	59	9	1				1	28	47	22
<i>moorei</i>	—	29	31	2	—	5	35	22	—				—	4	22	18
<i>camurum</i>	2	22	11	—	1	11	19	4	—				3	9	11	9
	Diagonal Scale Rows															
	Above Lateral Line						Anal to 1st Dorsal Fin								2nd Dorsal to Anal Fin	
	4	5	6	7	8	9	13	14	15	16	17	18	19	20	12	13
<i>rubrum</i>	—	—	60	48	—	—	3	4	44	36	19	2	—	—	1	37
<i>moorei</i>	3	6	42	10	1	—	—	—	1	12	25	18	6	—	—	3
<i>camurum</i>	—	2	15	12	5	1	—	—	3	11	8	9	2	2	—	4

nearly horizontal ventral contour. Caudal fin truncate. Nape, breast, and anterior fourth of belly naked. Check naked except for patch of six to nine exposed scales behind eye. Opercle scaled. Lateral line complete. Oblique subocular bar complete, but with a lighter section immediately below eye and a forward extension toward upper tip of maxillary. Pronounced double basicaudal spot. Only complete vertical bar on body encircles posterior end of caudal peduncle. Sexual dimorphism marked; male larger; male with few red spots on side of body; female with many such spots and with spotted fins; horizontal dark lines on posterior sides of body poorly developed in male, absent in female.

E. rubrum differs from *moorei* in many details of color and pattern and has more vertebrae, anal and pectoral rays, and fewer lateral line scales, transverse body scales, caudal peduncle scales and dorsal fin rays.

Description: Small with compressed and moderately streamlined body like *moorei*. Greatest body width close behind head. Greatest body depth at or close to dorsal fin origin. Snout moderately sharp. Caudal peduncle deep (Fig. 1).

In large adults, angle formed by upper and lower profiles of head varies from 26 to

43°, entering angles of muzzle 65-69°. Eyes located high on head; head, viewed laterally, slightly interrupted above by fleshy margin of orbit. Anterior and posterior profiles of top of head meet at angle of 147 to 155°. Profile of snout a straight line from eye to upper edge of premaxillary. Length of pelvic base much greater than pelvic interspace. In 10 adults ratio of pelvic interspace/pelvic base .40 to .50. Head length contained in standard length 3.2 to 3.4 times. Head longer than deep; depth at occiput contained in head length 1.5 to 1.7 times. Measurements of holotype (length in mm and in parentheses expressed as thousandths of standard length) are as follows: standard length 34.9, body depth at dorsal origin 7.3 (209); caudal peduncle depth 4.2 (120); body width 4.5 (129); caudal peduncle length 8.0 (229); highest dorsal spine 4.4 (126); highest dorsal soft ray 5.6 (106); caudal fin length 6.8 (195); first anal spine 3.9 (112); highest anal ray 4.9 (140); longest pectoral ray 8.4 (241); pelvic fin length 8.6 (246); pelvic fin base 1.6 (46); interpelvic space 0.7 (20); head length 10.1 (289); head depth (at occiput) 6.2 (178); head width 4.9 (140); snout length 2.3 (66); orbit length 2.2 (63); fleshy interorbital width 1.8 (51); upper jaw length 3.3 (94); lower

TABLE 2.
Fin-ray and vertebral counts in three species of *Etheostoma*

Species	First Dorsal				Second Dorsal						Total Dorsal Rays							
	10	11	12	13	9	10	11	12	13	14	20	21	22	23	24	25	26	
<i>rubrum</i>	26	76	6	—	—	6	67	34	1	—	3	23	47	31	4	—	—	
<i>moorei</i>	2	57	3	—	1	2	38	21	—	—	1	4	35	20	2	—	—	
<i>camurum</i>	—	5	28	2	—	—	4	23	7	1	—	—	1	6	20	6	2	

	Anal Soft Rays					Left Pectoral					Vertebrae				
	5	6	7	8	9	12	13	14	15		35	36	37	38	39
<i>rubrum</i>	1	—	52	54	1	1	34	72	1		1	54	49	1	—
<i>moorei</i>	—	1	49	12	—	5	46	11	—		3	34	6	—	—
<i>camurum</i>	—	—	11	23	1	—	1	26	8		—	—	10	30	1

jaw to juncture of branchiostegal membranes 5.4 (155); pelvic insertion to juncture of branchiostegal membranes 6.9 (198).

Body scaled except for breast and nape, and midline of belly for a distance extending one-fourth to one-third distance to anus. Opercle scaled; cheek naked except for patch of six to nine scales located immediately behind eye. One or two (usually embedded) scales in same region in some paratypes of *moorei* (CU 41966). Lateral line usually complete but occasionally a scale in advance of hypural poreless. Usually one or two normal-sized scales followed by three to five smaller scales behind hypural. Supratemporal canal complete, with three pores; supraorbital complete, with four pores; infraorbital complete, with eight pores; preopercularmandibular canal complete, with ten pores. Jaws, vomer and palatines well toothed. Branchiostegals are 6-6.

Coloration: Color differences are important in separating closely related species in the subgenus *Nothomotus*. Sexual dimorphism is pronounced. The following description is modified after one made by Dr. Ramsey based on specimens which had been in formalin for two days after their capture on 7 December 1963 and on notes made from live and freshly preserved specimens collected by Rancey and Sutkus on 1 February 1964.

In the male the head from the posterior interorbital area to the midfrenum has russet vermiculations on a field of dusky yellow. The area is bounded ventrally by a dark brown, thin preorbital bar, which originates just below the anterior midpoint of eye and slants forward and slightly downward to the maxillary and beyond to the

upper lip. Here the two preorbital bars do not coalesce, but extend posteriorly on the lip. The top surface of the snout is lighter than the head behind the eyes. The top of head from the posterior, interorbital region to the nape and downward to the upper posterior edge of opercle is russet-brown. The scaled portion of the opercle is dusky brown. A short, narrow, black postorbital bar covers part of the scaled portion of upper anterior cheek at the level of the lower edge of the pupil. A dark spot behind the upper part of the eye tends to circle upward and usually crosses the top of the head. The upper two-thirds of the cheek is yellow-orange and the lower one-third except for the very lower edge, is immaculate white. Fine black spots are scattered over the cheek and adjacent lower head except immediately before and after the suborbital bar. A black subocular bar extends obliquely backward from lower midpoint of eye to lower edge of the subopercle. Just below the eye a black spur from the suborbital bar extends forward beyond the posterior tip of the maxillary but does not reach the upper lip. The underside of the lower jaw has scattered melanophores which appear as a dark line. The area between the lower jaws has melanophores interspersed with yellow-orange chromatophores. In life this area is superficially iridescent pale green extending from the lower jaw symphysis to the subocular bar. The branchiostegal membranes are pale blue along the inner and posterior edges. Pupil amber and ringed by an iridescent golden iris.

The dark-brown nape is interrupted by a narrow, russet band which extends downward to about the level of the third scale

row above the lateral line just behind the posterior edge of the opercle. A short, sharply-defined humeral bar barely extends downward to a point slightly below the upper edge of the pectoral fin. The prepectoral region has diffuse melanophores on a pale orange background. The breast, to a point between the pelvic fins, is pale blue in life. The belly is white. The anus is encircled by yellow-orange.

The dorsum and upper sides of the body are brownish; the lower sides are lighter than the upper sides and olivaceous. In both sexes dark punctulations are scattered along the dorsum. In life about one-third of the males had one to 12 (mostly 1-3) bright red spots on the lower sides and occasionally there were yellow spots. Eight brownish saddles across the dorsum. Nine to 11 vague, vertical, brownish bars cross the body; the terminal bar at the posterior end of the caudal peduncle is best defined and encircles the caudal peduncle below. The penultimate bar is next best developed. The other bars tend to be interrupted and appear as diffuse dark blotches along the midside (see Fig. 1). A small area of the lower caudal peduncle at the anteriormost procurent rays is yellow, as is the venter just anterior to the dark band which encircles the caudal peduncle. The dorsal procurent rays are dark brown.

Females resemble males in coloration of the head and body, except there are more bright crimson dots forming irregular rows on the side of the body. These dots number from 26 to 56, and each covers the anterior one-third of a scale. Other spots are russet or brownish. The red dots are distributed from just before the tip of the appressed pectoral to the caudal peduncle and usually extends from four scale rows above to three scale rows below the lateral line. The female also has whitish dots on the body.

Narrow, dark horizontal lines are present on the posterior side of the body in the male (mostly on the caudal peduncle) but are faint in many specimens. They are fainter or absent in the female and are much less distinct than in other described species of the subgenus *Nothonotus*. In both sexes, but especially in the female (Fig. 1), the dark markings on the side of the body are outlined by irregularly shaped or rectangular light areas.

The fins of the sexes differ in coloration.

In the male the first dorsal fin has a narrow dark margin which is most noticeable on the posterior two-thirds of the fin. A narrow subterminal light band reaches close to, or to, the margin anteriorly. Beneath this is a broad red or orange-red band which is sharply defined anteriorly but posteriorly diffuses over the lower half of the fin. This band is brightest on the posterior edge of each spine and contrasts with the duller interradiial membrane. The extreme base of the fin fades to yellow-brown. In large adults particularly, the larger melanophores usually are distributed evenly on the basal two-thirds of the membranes. There is a spot at the base of each membrane.

In the female the first dorsal fin has a very narrow dark margin but in some specimens this margin is only partially developed; in a few, particularly small individuals, it is absent. Below the dark margin is a light area which is most prominent behind each spine and which forms an ill-defined horizontal band. A reddish band which is brightest anteriorly extends near the lower base of the fin and grades into dusky-brown at the base. This fin tends to be somewhat more spotted than in the male but basically the coloration in life or in freshly preserved specimens is the same. Superficially the first dorsal fin appears red on the lower half of the fin, has a thin dark margin and an intermediate light area.

The edge of the second dorsal fin in the male is bordered by a blackish band but the very tips of the rays are light. The blackish band is narrowest anteriorly. A narrow, submarginal, whitish band parallels the blackish band. A broad red or red-orange band extends through the middle of the fin. The lower third or fourth of the fin is olive. At the very base of the membranes there are dark spots.

The second dorsal in the female also has a moderately defined, dark terminal band. A red band is absent but red or russet spots are scattered over the fin. In addition, black spots are located mostly on the rays and appear in four or five irregular rows. A row of brownish spots is present on the base of the membranes. In life the red spots are prominent.

The anal fin of the male is much like the second dorsal fin. The former has a narrow light margin and a blue-black submarginal band in the soft-rayed portion of the fin.

The membranes associated with the first two rays (spines) were blue-green for their entire length except for a narrow vertical orange slash; the area is clear in preserved specimens. A red band extends through the middle of the anal. The base of the fin is olive or yellowish with dark spots at the base of the membranes.

In the female the anal fin is also like the second dorsal fin. An inner band in life is a red or red-orange. Usually three or four brown or red quadrate spots are found adjacent to each ray.

The caudal fin of the male has a very narrow terminal clear area and a subterminal black band of about the same width. Anterior to the latter is a yellowish band about half again as wide as the black band; the remainder of the fin is reddish with some yellow on the fin rays. A prominent character is the two dark basicaudal spots which tend to coalesce in some specimens.

In the female the caudal fin has a narrow terminal clear band and a blue-black subterminal band which is better developed in some specimens than others. The remainder of the fin is crossed by four or five wavy rows of spots which are russet or red in life and which in preserved specimens appear as small dark spots. As in the male there are two prominent dark basicaudal spots.

The posterior third of the pectoral fin in the male is clear. The lower rays are thickened near the tip. The basal two-thirds of the pectoral is pink or red; the latter is more pronounced on the rays and presents a streaked appearance. The fleshy base bears a prominent pink crescent. The prepectoral area lacks a strongly developed bar.

The pectoral fin of the female is colored much like that of the male. The outer one-fourth or one-third is clear; the extreme base is crossed by a pink crescent and the fin is red on the basal half. The rays are yellowish throughout. In preservative the rays bear scattered dark spots. There is no strong prepectoral bar.

The pelvic fin spine of the male has a whitish opaque tip. The tips of the lower rays are thickened and milky in color in both sexes. The basal two-thirds or three-fourths of the fin is red or orange-red and the color is concentrated mostly on the rays. The distal third or fourth of the fin is clear.

In the female the posterior tip and a small area at the base of the pelvic fin are

clear. The central portion is yellowish with scattered brown and red spots. In preserved specimens there are two to three dark spots on the inner rays.

The urogenital papilla in the male taken February 1 is flattened and subtriangular with the apex pointing posteriorly; the apex does not reach the anterior base of the first anal spine. In the female the papilla is rounded posteriorly and in both sexes parallel grooves line the lower surface.

Males average slightly larger than females and in each of the six collections which contained more than one specimen a male was the largest specimen taken. Large young and yearlings have female-like spotted fins. Some yearlings were 21-22 mm in standard length and this size may represent the largest individuals at one year. *E. rubrum* probably spawns when two years old, and three years may be the maximum length of life as judged from a study of the length frequency distributions. A 46 mm male was the largest specimen captured.

Comparisons and relationships: Contrary to our statements in Copeia, 1964 (1):138, *E. rubrum* is closely related to *moorei* and they and an undescribed species from the Cumberland and Tennessee rivers form a species group in the subgenus *Nothonotus*. In these species the male is larger. *E. rubrum* is smaller than the other species. A comparison of *rubrum* with *moorei* (Tables 1-3) shows that the differentiation in most meristic characters is at a relatively low level, but is sharpest in number of lateral line scales. Like other species in the subgenus *Nothonotus* color pattern is an important species character. The major pattern differences are given in Table 3. Bright red color in females is unusual in darters where the males usually are more brilliantly colored.

Superficially *rubrum* resembles *camurum* in meristic characters but differs most in dorsal, anal, and pectoral rays and vertebral counts. However, *camurum* is recognized by us as a complex of subspecies and species and a generalized comparison is difficult. Data for *camurum* given in Tables 1 and 2 are for specimens taken from the Ohio River System as are the pattern differences noted below. The female of *rubrum* has prominent dark spots on the fins which are lacking in *camurum*. Both sexes in the former have the double dark basicaudal spot; none is present in *camurum*. A sharp, oblique, dark

TABLE 3.
A comparison of *Etheostoma rubrum* and *E. moorei*

Character	<i>rubrum</i>	<i>moorei</i>
Patch of scales behind eye	From 6 to 9 large exposed scales	None, or one or 2 small scales
Eye	Longer than snout	Equals or shorter than snout
Prominent red spots on sides of body	Present; more so in ♀	Absent or few in either sex
Dark punctulations on dorsal 3rd of body	Abundant	Absent or few
Dark horizontal streaks on posterior 3rd of body	Poorly developed; very faint in ♀	Moderate in both sexes, but fainter in ♀
Dark edge of dorsal and caudal fins	Weak or moderately developed	Prominent
Red bands in dorsal fins	Present in both sexes	Absent
Dark suborbital bar	Narrow and sharp	Wide and diffuse posteriorly
Cheek	Light	Dusky
Dark spot in procurent caudal rays	Small	Large
Usual number of:		
1st dorsal spines	10-11	11
2nd dorsal soft rays	11-12	11-12
Total dorsal rays	21-23	22-23
Left pectoral rays	13-14	13-14
Anal soft rays	8 (often 7)	7 (sometimes 8)
Vertebrae	36-37	36
Usual number of scales:		
Lateral line	50-53	53-57
Anal to 1st dorsal	15-17	16-18
2nd dorsal to anal	13-15	14-16
Around caudal peduncle	19-21	20-22

suborbital bar is present in *rubrum* but is absent in *camurum*. Dark horizontal streaks are found in both sexes in *camurum* but are poorly developed in *rubrum*. The body of *camurum* is huskier and the snout is blunter than in *rubrum*. The cheek is naked in *camurum*, whereas *rubrum* has some large exposed scales behind the eye.

Distribution: *E. rubrum* is known only from the type-locality in Bayou Pierre and from its major tributary, White Oak Creek. Attempts by us and others to take it elsewhere in the same and nearby stream systems have failed. The preferred riffle habitat probably is limited and the range thus is restricted.

Ecology and associates: On 1 February 1964, *E. rubrum* was taken by Raney and Suttkus in a long riffle at the type-locality using a 12x6 foot nylon seine with 1/4 inch mesh. At this time the flow was moderate and the riffle-pool habitat varied in width from 60 to 100 feet. The depth in the deeper sections of the riffles approached three feet and that in the pools exceeded five. The

water was slightly turbid. No vegetation was present.

The bottom was bedrock and was partly covered by loose gravel with an occasional sand bar or a mixture of sand and small gravel. *E. rubrum* was usually taken over gravel near, but not in, the swiftest current. Earlier at the same place on 7 December 1963, Dr. Ramsey took both juveniles and adults in moderately swift current over packed gravel. He noted that adults were most abundant near the head of riffles in water less than one foot deep but that some were found in the more turbulent areas. *E. rubrum* was taken most often in the same seine haul with *Etheostoma zonale* (Cope) and *Noturus hildebrandi* (Bailey and Taylor) but *E. rubrum* frequently was found in deeper water. *E. rubrum* was taken infrequently in the same set with *Percina uranidea* (Jordan and Gilbert) and rarely with *Percina sciera* (Swain). Other species taken in the same riffles or nearby pools were: *Dorosoma cepedianum* (LeSueur), *Hypentelium nigricans* (LeSueur), *Moxostoma*

poecilurum (Jordan), *Ericymba buccata* Cope, *Hybognathus nuchalis* Agassiz, *Hybopsis amblops* (Rafinesque), *Hybopsis bellica* (Girard), *Notemigonus crysoleucas* (Mitchill), *Notropis atherinoides* Rafinesque, *Notropis camurus* (Jordan and Meek), *Notropis chrysocephalus isolepis* Hubbs and Brown, *Notropis longirostris* (Hay), *Notropis lutrensis* (Baird and Girard), *Notropis v. venustus* (Girard), *Notropis volucellus* (Cope), *Pimephales notatus* (Rafinesque), *Pimephales vigilax perspicuus* (Girard), *Ictalurus punctatus* (Rafinesque), *Noturus miurus* Jordan, *Noturus funebris* Gilbert and Swain, *Fundulus notatus* (Rafinesque), *Chaenobryttus gulosus* (Cuvier), *Lepomis megalotis* (Rafinesque), *Micropoterus p. punctulatus* (Rafinesque), *Am-*

mocrypta asprella Jordan and Meek, *Ammocrypta beani* Jordan, *Ammocrypta vivax* Hay, *Etheostoma bistris* Jordan and Gilbert, *Etheostoma stigmaeum* (Jordan), and *Etheostoma whipplei artesia* (Hay).

REFERENCES CITED

- HUBBS, CARL L. and KARL F. LAGLER. 1958. Fishes of the Great Lakes region. *Cranbrook Inst. Sci. Bull.* 26: 1-213, 44 pls., 251 figs.
- RANEY, EDWARD C. and ROYAL D. SUTTKUS. 1964. *Etheostoma moorei*, a new darter of the subgenus *Nothonotus* from the White River System, Arkansas. *Copeia* 1964(1): 130-139, fig. 1.

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